

Effectiveness of Contrast Enhanced Power Doppler Ultrasonography in The Flaccid Penile State *

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ÖZET

Flask peniste eko-kontrastlı power doppler ultrasonografinin etkinliği

Amaç: Flask penis durumunda yapılan kontrastlı power Doppler ultrasonografinin (CE-PDU) erektil disfonksiyon (ED) tanısı ve vasküler patoloji ayırıcı tanısındaki etkinliğini araştırmak.

Gereç ve Yöntem: Eretil disfonksiyonlu 20 hastanın rutin değerlendirmesinin ardından her korporal ünitenin kavernozaal arterlerinden başlangıçta, eko-kontrast ajan sonrasında ve vazoaaktif ajan sonrasında olmak üzere tepe sistolik hız değerleri (sırasıyla PSV1, PSV2 ve PSV3) ölçüldü. End diyastolik hız (EDV) sadece vazoaaktif ilaç enjeksiyonundan sonra ölçüldü. Vasküler patoloji PSV3 ve EDV değerlerine göre sınıflandırıldı.

Bulgular: PSV1 hastaların %58 ve PSV2 %93'ünde ölçülmesine rağmen PSV1, PSV2 ve PSV3 ölçülme oranları arasındaki fark istatistiksel olarak anlamlı değildi. PSV3, PSV1 ve PSV2 değerlerinden istatistiksel olarak farklıyken PSV 1 ve PSV2 arasındaki fark anlamsızdı. Vasküler subgruplar arasında PSV1 değerleri farklı değildi, fakat PSV2 ve PSV3 değerleri anlamlı derecede farklıydı.

Sonuçlar: Bu çalışmaya göre istatistiksel olarak anlamlı olmasa da CE-PDU klasik power Doppler ultrasonografi ile karşılaştırıldığında flask penisde daha fazla arteriyel sinyal gösterebilmekte ve flask peniste PSV için bir eşik değeri saptamada ve böylece ED ayırıcı tanısında ümit verici bir teknik gibi gözükmektedir.

Anahtar kelimeler: Eko-kontrast ajan, erektil disfonksiyon, power Doppler ultrasonografi

ABSTRACT

Effectiveness of contrast enhanced power doppler ultrasonography in the flaccid penile state

Objective: To investigate the effectiveness of contrast-enhanced power Doppler ultrasonography (CE-PDU) in diagnosing erectile dysfunction (ED) in the flaccid penile state, and in differentiating vascular pathology.

Material and Methods: After routine evaluation of 20 patients with ED, peak systolic velocity (PSV) values were measured at baseline (PSV1), after echo-contrast agent (PSV2), and after vasoactive agent (PSV3) on the cavernosal arteries for each corporeal unit. End diastolic velocity (EDV) was only measured after vasoactive drug injection. Vascular pathology was classified according to PSV3 and EDV values.

Results: PSV1 was measured in 58% and PSV2 in 93% of the patients, although the differences among the measurement rates of PSV1, PSV2 and PSV3 were not statistically significant. The PSV3 value was statistically different from those of PSV1 and PSV2, while the difference between PSV1 and PSV2 was insignificant. Among vascular subgroups PSV1 values were not different, but PSV2 and PSV3 values were significantly different.

Conclusion: According to this study CE-PDU could show much more arterial signals in the penile flaccid state compared to classical power Doppler ultrasonography, though it was not statistically significant, so it seemed to be a promising technique in determining a cut-off value for PSV in the penile flaccid state, thus in making differential diagnosis of ED.

Key words: Echo-contrast agent, erectile dysfunction, power Doppler ultrasonography

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INTRODUCTION

In classical Doppler examination of erectile dysfunction (ED), penile erection is required to measure particularly

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peak systolic velocity (PSV) and end diastolic velocity (EDV). Erection is generally provided with somewhat invasive techniques such as intracavernous injections, though Doppler examination with various oral agents has been recently defined (1,2).

Furthermore, it would be reasonable to benefit from PSV measured in flaccid penile state in evaluation of penile arterial system. Interestingly there are a few clinical studies evaluating arterial flow in flaccid penile state in Doppler ultrasound examination (3,4). The main

problem is poor visualization of arterial flow obtained with classical Doppler machines. This difficulty can be overcome by using new technology such as Power Doppler ultrasound (PDU) or by improving image quality of arterial flow with echo-contrast agents (5).

Echo-contrast drugs have been already used in some Doppler examinations such as echocardiography at present, but, to our knowledge, contrast usage in penile Doppler ultrasound has not been investigated yet (6).

In this study, we tried to investigate whether contrast-enhanced PDU (CE-PDU) can enhance the value of PDU in the flaccid penile state, and whether CE-PDU can contribute to differential diagnosis of vascular pathology in ED.

MATERIAL AND METHODS

Consecutive 20 patients with ED were included in this study. The research was performed following the Declaration of Helsinki principles. After informed consent obtained from the patients and routine evaluation including ED history, baseline PSV values on the cavernosal arteries for each corporeal unit were measured with PDU (PSV1). The second PSV measures (PSV2) were obtained after administration of the echo-contrast agent including galactose and palmitic acid (Levovist, 2.5 g in 200 mg/ml concentration, Schering AG, Berlin, Germany) via an antecubital vein followed by the immediate 10 mL of 0.9% sodium chloride injection. Lastly the third (PSV3) measures were taken following

samples by Wilcoxon signed ranks and Friedman tests, and those in independent ones by Kruskal-Wallis H test.

RESULTS

The mean age was 43 years (SD: 12). The differences between the determination rates of PSV1, PSV2 or PSV3 were not statistically significant ($p > 0.07$ for all comparisons, chi-square test), though the observation rate of arterial flow was 23/40 corporeal units for PSV1 versus 37/40 for PSV2 ($p = 0.069$, Chi-square test) (Table 1).

The mean value of PSV3 was statistically different from those of PSV1 and PSV2 ($p < 0.001$ for both comparisons, Wilcoxon test), while the difference between PSV1 and PSV2 was insignificant ($p = 0.262$, Wilcoxon test) (Table 1).

In patient groups categorized by vascular pathology, the mean values of PSV1 were not statistically significantly different, but those of PSV2 and PSV3 were significantly different (Table 2).

Table 1: Peak systolic velocity values measured at baseline (PSV1), following echo-contrast agent (PSV2) and following papaverine injection (PSV3).

	Total	n ^a (%)	Mean (cm/s)	+/- SD
PSV1	40	23 (58)	17.0	+/- 5.9
PSV2	40	37 (93)	19.4	+/- 6.8
PSV3	40	38 (95)	53.0	+/- 18.6
p ^b				<0.001

a, The number of corporeal units in which arterial flow was observed.

b, According to Friedman test.

Table 2: The comparisons of peak systolic velocity values according to vascular pathology.

	Total	Normal		Arteriogenic		Venogenic		unknown		p ^a
		n	mean (cm/s)	n	mean (cm/s)	n	mean (cm/s)	n	mean (cm/s)	
PSV1	23	8	17.1	2	9.5	12	18.0	1	20.0	0.151
PSV2	37	15	22.2	4	12.3	16	19.4	2	12.5	0.029
PSV3	38	17	63.4	5	24.0	16	51.0	0	-	0.000

a, According to Kruskal-Wallis H test.

intracavernous papaverine injection. End diastolic velocity was only measured after papaverine injection. Ultrasound examinations were performed by one radiologist (M.K.). According to flow parameters, PSV3 ≥ 35 cm/s was suggestive for normal arterial flow, PSV3 ≤ 30 cm/s for arteriogenic ED, PSV3 ≥ 35 cm/s plus EDV ≥ 5 cm/s for venous leakage.

Determination rates of PSV were statistically compared by using Chi-square; mean values in related

DISCUSSION

The main problem in the flaccid penis prior to intracavernous vasoactive agent is difficulty in evaluating arterial flow, and has been overcome by enhancing arterial imaging with the echo-contrast drug in this study. According to our results, to our knowledge, it was clearly shown that CE-PDU could make arterial signals more visible compared to classical PDU in the

penile flaccid state, though this finding was not statistically significant. However our limited series should be taken into consideration in this statistical inference.

Arterial imaging is more favorable in CE-PDU than in PDU in flaccid state of the penis, though CE-PDU performed without vasoactive agent is unsurprisingly incapable to evaluate venous leakage. Namely, CE-PDU may be advisable technique in evaluation of patients with more likely arteriogenic ED because of the difficulty in making diagnosis of venogenic ED without vasoactive agents. In addition to diagnostic insufficiency in venogenic ED, other disadvantages of CE-PDU include moderate invasiveness and relative expensiveness.

Additionally whether a PSV value in the penile flaccid state predicting arterial insufficiency could be found or not was investigated by only a few authors. Of them, Mancini et al. and Roy et al. suggested that a PSV value of 10 and 12.5 cm/s, respectively measured in penile flaccid state could be used as cutoff in predicting arterial pathology in most of the patients (3,4).

In our study, the mean PSV value was 9.5cm/s in the flaccid state prior to contrast and vasoactive agents, and indifferent from those of normal subjects and other patients. On the other hand, it was 12.3cm/s after

contrast agent, but before vasoactive drug, and furthermore statistically different from those of other groups. According to these data CE-PDU seems to distinguish arteriogenic ED from the others. Namely it might be concluded that CE-PDU could be a promising technique in determination of a cut-off value for PSV in the penile flaccid state in arteriogenic pathologies, thus in making differential diagnosis of ED.

Although these promising outcomes of CE-PDU were obtained in evaluating arterial flow in the penile flaccid state, to conclude more exact outcomes, (a) CE-PDU examinations can be repeated with higher contrast doses, (b) the study can be performed with three-dimensional Doppler ultrasound, (c) echo-contrast agents can be combined with noninvasive erectogenic agents such as sildenafil citrate to increase the power of CE-PDU in diagnosis of venogenic ED, and (d) a cut-off value for PSV in the penile flaccid state can be estimated with larger patient series to diagnose arteriogenic ED.

According to this study, CE-PDU performed without vasoactive agents seems to be a promising technique in particularly diagnosis of arteriogenic ED due to the feasibility in determining arterial flow and even a cut-off value for PSV in the penile flaccid state.

REFERENCES

1. Ardicoglu A, Kocakoc E, Tuygun UO, Bozgeyik Z, Orhan I. Effectiveness of vardenafil versus papaverine in penile Doppler ultrasonography. *Urol Int* 2005; 75: 75-79.
2. Cianciulli TF, Lax JA, Beck MA, et al. Usefulness of myocardial contrast echocardiography early after acute myocardial infarction. *Echocardiography* 2006; 23: 208-217.
3. Copel L, Katz R, Blachar A, Sosna J, Sheiman RG. Clinical and duplex US assessment of effects of sildenafil on cavernosal arteries of the penis: comparison with intracavernosal injection of vasoactive agents--initial experience. *Radiology* 2005; 237: 986-991.
4. Klingler HC, Kratzik C, Pycha A, Marberger M. Value of power Doppler sonography in the investigation of erectile dysfunction. *Eur Urol* 1999; 36: 320-326
5. Mancini M, Bartolini M, Maggi M, Innocenti P, Villari N, Forti G: Duplex ultrasound evaluation of cavernosal peak systolic velocity and waveform acceleration in the penile flaccid state: clinical significance in the assessment of the arterial supply in patients with erectile dysfunction. *Int J Androl* 2000; 23: 199-204.
6. Roy C, Saussine C, Tuchmann C, Castel E, Lang H, Jacqmin D. Duplex Doppler sonography of the flaccid penis: potential role in the evaluation of impotence. *J Clin Ultrasound* 2000; 28: 290-294.